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**Pez et al.**

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(54) **HYDROGEN STORAGE BY REVERSIBLE  
HYDROGENATION OF PI-CONJUGATED  
SUBSTRATES**

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patent is extended or adjusted under 35  
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This patent is subject to a terminal dis-  
claimer.

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**Related U.S. Application Data**

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**C01B 3/00** (2006.01)  
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48/61

(58) **Field of Classification Search** ..... 423/644,  
423/648.1; 206/0.7; 48/61  
See application file for complete search history.

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(57) **ABSTRACT**

Processes are provided for the storage and release of hydro-  
gen by means of a substantially reversible catalytic hydroge-  
nation of extended pi-conjugated substrates which include  
large polycyclic aromatic hydrocarbons, polycyclic aromatic  
hydrocarbons with nitrogen heteroatoms, polycyclic aro-  
matic hydrocarbons with oxygen heteroatoms, polycyclic  
aromatic hydrocarbons with alkyl, alkoxy, nitrile, ketone,  
ether or polyether substituents, pi-conjugated molecules  
comprising 5 membered rings, pi-conjugated molecules com-  
prising six and five membered rings with nitrogen or oxygen  
hetero atoms, and extended pi-conjugated organic polymers.  
The hydrogen, contained in the at least partially hydrogenated  
form of the extended pi-conjugated system, can be facilely  
released for use by a catalytic dehydrogenation of the latter in  
the presence of a dehydrogenation catalyst which can be  
effected by lowering the hydrogen gas pressure, generally to  
pressures greater than 0.1 bar or raising the temperature to  
less than 250° C. or less, or by a combination of these two  
process parameters.

**62 Claims, 19 Drawing Sheets**